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THE PECULIAR BEHAVIOUR OF THE 5780 AND 5797 DIBS IN HD25137

I. Porceddu¹ and P. Benvenuti^{2,3}

¹ Astronomical Observatory, Cagliari (Italy)

² Space Telescope - European Coordinating Facility, Garching bei München
(Germany)

³ Physics Department, University of Cagliari (Italy)

ABSTRACT

The interstellar environment close to the high latitude molecular cloud Lynds 1569 (L1569, Lynds 1962), also known as MBM 18 (Magnani, Blitz and Mundy, 1985), has been analyzed by Penrose et al. (1990) and Penrose (1993). Their observations of the CH, CH⁺ and CN molecular features, are consistent with a region having a high molecular and a reduced dust content. They also observed the background star HD 24263 - located 8 degrees far from the center of L1569 - reporting a CH rich line of sight and the presence of two intervening clouds from the sodium lines spectra. The infrared excess which has been revealed by the IRAS survey at 12 μ m might suggest the presence of PAHs molecules, the well known candidate for the Unidentified Infrared Bands and Diffuse Interstellar Bands.

This interesting scenario led us to start investigate the behaviour of the diffuse interstellar bands toward HD 25137, which is supposed to be a background object for L1569 (Penrose et al., 1990); as well as the field star HD 24263. As part of a wider observational program devoted to study the HLCs special environments, we present here the observations of the diffuse interstellar bands (DIBs) at 5780 and 5797 $\lambda\lambda$ in the direction of the two above mentioned stars, HD 24263 and HD 25137.

OBSERVATIONAL DATA

The high latitude molecular clouds are supposed to be a quite distinct subset within the whole family of molecular clouds. Their different chemical and physical behaviour is characterized by the enrichment in CH if compared to the normal dark cloud abundances of similar extinction. The CH content, the possible presence of a shock region and the infrared excess at 12 μ m suggested us to analyze the presence, behaviour and characteristics of the DIBs in a HLC environment. The preliminary results we are presenting here are part of this observational programme, which is still in progress. The main parameters for the two stars are reported in the Table 1.

	H D 24263	H D 25137
l	182.04	188.13
b	-34.88	-36.28
Sp/L	B9 V	B9 / A0
V	5.6	8.1
$E(B-V)$	0.24	0.13
Eq. width 5780	174	151
Eq. width 5797	72	65
5780 DIB wavelength	5780.58	5780.81
5780 DIB depth	6.50%	6.00%
5797 DIB wavelength	5797.11	5797.22
5797 DIB depth	4.80%	4.50%

Table 1

Table 1 also includes the DIBs peak wavelengths corrected to LSR, as well as the equivalent width and depth of the absorption features as percentage of the unit baseline.

Figures 1 and 2 show the normalized profiles of the two program stars as obtained from the CES spectrograph fed by the ESO CAT 1.4 m. telescope.

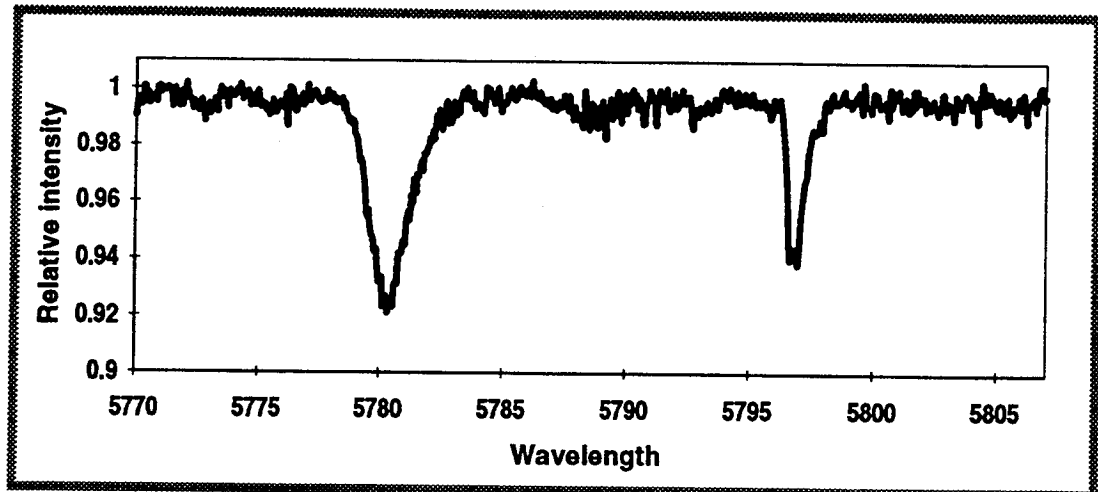


Figure 1: HD 24263

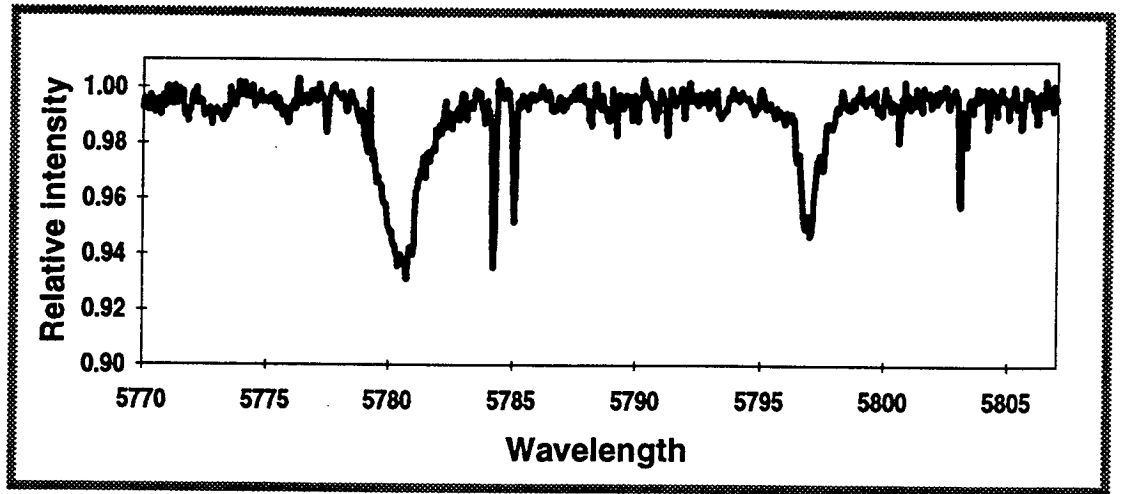


Figure 2: HD 25137

Both 5780 and 5797 features are clearly visible, although HD 25137 is showing some stellar features which are characteristics of an "A" spectral type: nevertheless, the profile of the DIB is not affected. In the spectrum of the field star HD 24263 the broad DIB centered at 5788 Å is also present, which overlaps the known set of telluric lines.

Figures 3 and 4 show the DIBs of the two target stars superimposed. The 5780 features is slightly different on the blue side, while the profile at 5797 is much more similar. For the latter DIB a composite structure might be suggested.

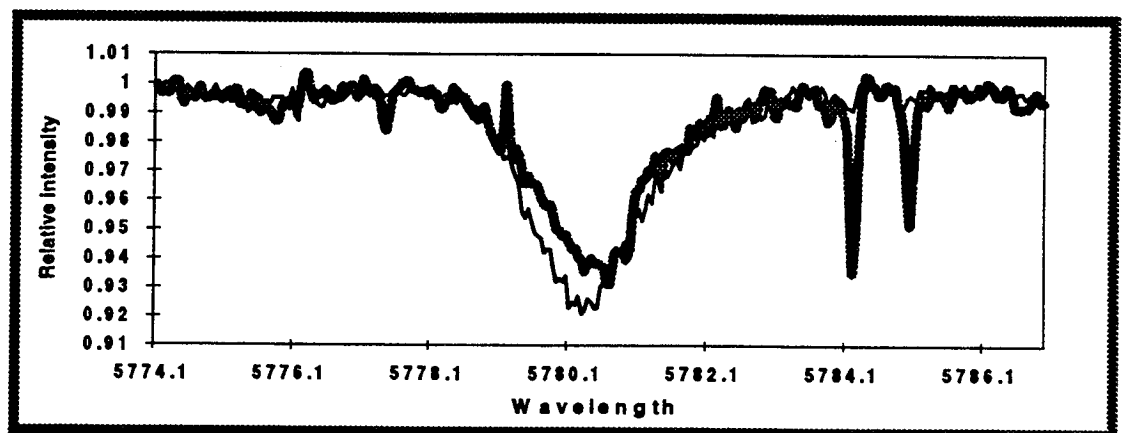


Figure 3: The 5780 DIB profiles of the two stars, HD 24263 (thin line) and HD 25137 (thick line)

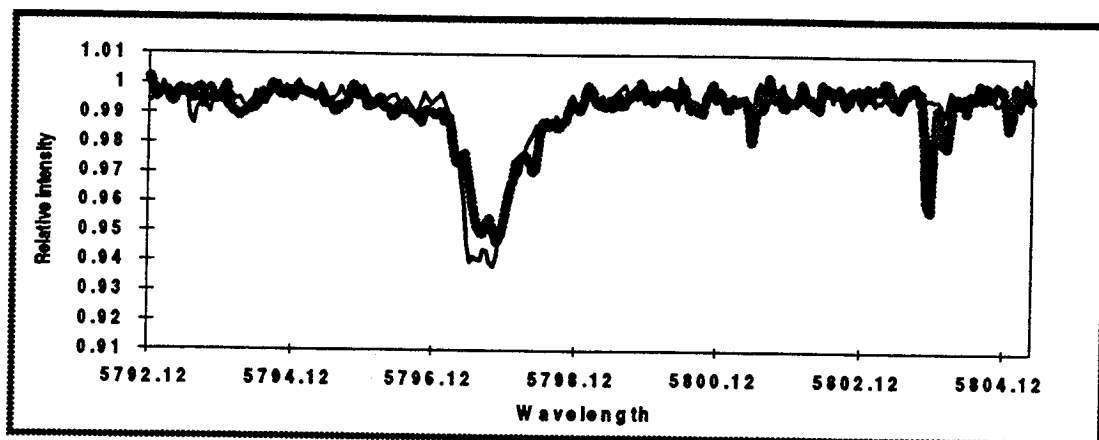


Figure 4: The 5797 DIB profiles of the two stars, HD 24263 (thin line) and HD 25137 (thick line)

DISCUSSION

The analysis of the DIBs' profiles of the two programme stars suggests a similar behaviour of the diffuse bands at 5780 and 5797 Å. HD 25137, which shines thru L1569, and HD 24263, a field star 8° far from the center of the molecular cloud, show a common DIBs shape and share the interstellar environment from the DIBs point of view: furthermore, according to Penrose et al. (1990) the two stars show the same behaviour with respect to the observed molecular lines. The measured DIBs' peak wavelengths reported in Table 1 are in agreement, if the Herbig's (1975) values are used, with carrier(s) associated to the low velocity cloud at 9 kms⁻¹, which is found from the Na D-lines spectra (Penrose et al. 1990), identified with L1569 itself.

The unexpected result is the large value of the DIBs equivalent widths in HD 25137 when compared to its colour excess.

	<i>l</i>	<i>b</i>	<i>V</i>	<i>E(B-V)</i>	5780	5797	N5780	N5797
HD 24263	182	-34.88	5.6	0.24	174	72	725	300
HD 25137	188.1	-36.28	8.1	0.13	151	65	1162	500
HD 21483	158.9	-21.31	7.1	0.58	280	160	483	276
HD 147701	352.3	16.85	8.35	0.72	380	110	528	153
HD 29412	204.7	-33.51	8.8	0.33	220	100	667	303
HD 92741	287.3	-1.11	7.6	0.25	178	55	712	220
HD 144470	352.8	22.76	3.9	0.22	178	52	809	236

Table 2

Table 2 reports the equivalent widths normalized to E(B-V) for our two targets as well as for five further objects. Two of them are "dark cloud stars", HD 21483 and HD 147701 (Snow and Cohen 1975); the last three objects belong to diffuse environments (Benvenuti and Porceddu, 1989). Figure 5 shows the comparison between the equivalent width normalized to the reddening for the 5780 (solid bar) and 5797 DIB (striped bar): the background of the MBM 18 molecular cloud seems to show a very high efficiency, in spite of the dark cloud like environment.

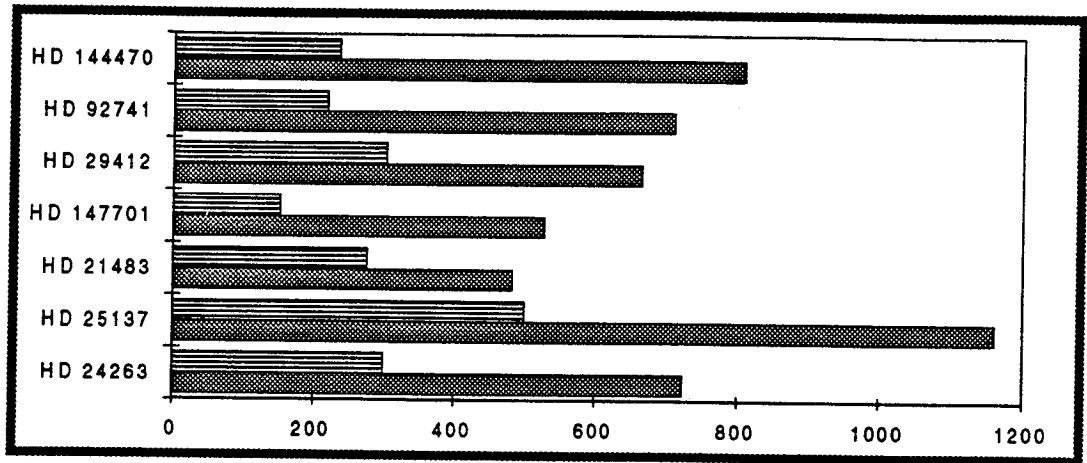


Figure 5

If the Penrase et al.(1990) value of reddening for HD 25137 is assumed, this star shows an anomalous value for the 5780 and 5797 DIBs strength. The normalized W_λ is twice the value showed by the comparison star HD 24263, a result which is against the widely accepted hypothesis that the strengths of the DIBs at 5780 and 5797 Å tend to be deficient with respect to color excess in the lines of sight to stars lying behind dense interstellar clouds (Snow and Cohen, 1974), as the high latitude molecular cloud L1569 is believed (Penrase et al. 1990). The DIBs' carriers, provided that the 5780 and 5797 Å features belong to two different subset/families of DIBs, are both present; moreover, they show a very high efficiency, much more higher with respect to diffuse clouds environments.

On the other hand, this unexpected result could also be driven by the incorrect determination of the E(B-V) colour excess reported by Penrase et al. (1990), which is not likely to be accepted. This unexpected result must be supported by further observational data, aiming to explain this apparently very high efficiency in producing DIBs. A region with a reduced dust content, a molecules-enriched environment and the presence of a shock region might be exciting constraints for providing a further step forward in the DIBs puzzle.

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